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PROJECT COMPLETION REPORT

KOREA

SEOUL-BUSAN CORRIDOR PROJECT
(LOAN 2600-KO)

OCTOBER 22, 1993

Infrastructure Operations Division
Country Department I
East Asia and Pacific Regional Office

CURRENCY EQUIVALENT

US$ 1 = W 780 (as of May 1993)

FISCAL YEAR

January 1 - December 31

WEIGHTS AND MEASURES

1 meter (m)	=	3.2808 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 square kilometer (km2)	=	0.3861 square miles (sq mi)
1 metric ton (m ton)	=	2,204.6226 pounds (lbs)

PRINCIPAL ABBREVIATIONS AND ACRONYMS

ATS	-	Automatic Train Stop System
ATC	-	Auto Train Control
BOA	-	Board of Auditors
CTC	-	Central Train Control
EIRR	-	Economic Internal Rate of Return
GIE	-	Government Invested Enterprise
GNP	-	Gross National product
GOK	-	Government of Korea
ICB	-	International Competitive Bidding
KNR	-	Korean National Railroad
MIP	-	Management Improvement Program
MOT	-	Ministry of Transportation
MOF	-	Ministry of Finance
PCR	-	Project Completion Report
PPAR	-	Project Preparation Audit Report
SAR	-	Staff Appraisal Report
SMESRS	-	Seoul Metropolitan Electrified Suburban Railway System

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

Office of Director-General
Operations Evaluation

October 22, 1993

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Korea
Seoul-Busan Corridor Project (Loan 2600-KO)

Attached is the "Project Completion Report on Korea -- Seoul-Busan Corridor Project (Loan 2600-KO)" prepared by the East Asia and Pacific Region. Part II contains the Borrower's comments.

Loan 2600-KO (US$67.0 million equivalent of July 1985) was to increase transport capacity in the railway corridor connecting the two major Korean centers. The Project encompassed track signalling, investments in rolling stock and equipment, technical assistance, and staff training.

Except for some procurement problems and communication difficulties (arising out of the Borrower's shortage of English-speakers, and a symmetrical shortage of Korean-speakers among consultants and technical assistance staff), implementation was smooth. The three-year delay in project completion was due to inappropriate selection of suppliers for cables and software. Overall, the project is rated as satisfactory, its sustainability as likely, and its institutional impact as substantial.

The PCR offers an adequate account of project performance. It notes that processing of a "Railroad System Modernization Project" was suspended in 1992 because Government decided to delay the conversion of Korean Railways into a "Government Invested Enterprise". This strong stance by the Bank is the culmination of Bank efforts to persuade the Government that Korean Railways ought to be granted full autonomy, efforts which date back to the 1978 Sixth Railway Project. They continued under the 1980 Seventh Railway Project, the 1983 Coal and Cement Project, the 1985 Seoul-Busan Corridor Project, and the 1988 Kyonggi Regional Transport Project. In each and every case, Government promised to grant autonomy by a certain date and then explained that more time was needed.

The project may be audited together with the Kyonggi Regional Transport Project.

Robert Picciotto
by H. Eberhard Köpp

KOREA
SEOUL-BUSAN CORRIDOR PROJECT (LOAN 2600-KO)
PROJECT COMPLETION REPORT
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KOREA
SEOUL-BUSAN CORRIDOR PROJECT
(LOAN 2600-KO)

PROJECT COMPLETION REPORT

Preface

This is the Project Completion Report (PCR) for the Seoul-Busan Corridor Project in Korea, for which Loan 2600-KO, in the amount of US$ 67.0 million equivalent was approved on July 2, 1985. The closing date of the loan was extended from December 31, 1989 to December 31, 1992. Disbursements under the loan totaled US$32.9 million, with final disbursement made on February 26, 1993. US$31.4 million was canceled effective July 16, 1986, US$1.0 million was cancelled effective September 26, 1989 and US$1.65 million was cancelled effective March 11, 1993.

The PCR was jointly prepared by the Infrastructure Division of the Asia Technical Department (ASTIN), the Infrastructure Operations Division (EA1IN) of the East Asia and Pacific Regional Office and the Borrower, and is based, inter alia, on the Staff Appraisal Report (SAR), the Loan Agreement, supervision reports, the Borrower's own records, correspondence between the Bank and the Borrower, and internal Bank memoranda.

KOREA
SEOUL-BUSAN CORRIDOR PROJECT
(LOAN 2600-KO)

PROJECT COMPLETION REPORT

Evaluation Summary

Objectives

The prime objective of the project was to make a direct contribution to the Government of Korea's (GOK) overall plan for increasing transport capacity in the Seoul-Busan Corridor. Another objective was to enable addition the Bank to continue its dialogue with the Government and Korean National Railroad (KNR) on institutional strengthening, multi-modal transport planning, as well as longer term investment planned for the corridor.

Implementation Experience

Implementation was for the most part routine with two exceptions. On the one hand, local suppliers were able to substantially under bid the world market, resulting in savings which allowed the Central Train Control (CTC) re-signaling component to be expanded. Problems, however, were caused by a shipment of defective cables which had to be re-manufactured and software that required extensive re-working. The expansion in project scope, combined with the cable and software problems, extended the project implementation period by three years.

Sustainability

The main part of the project which involved standard, well established technology - the signaling component - is expected to be adequately maintained, and the improvements brought about by its installation are likely to be sustained and even improved in the years to come. However, full utilization of the advanced technology in the computer aided CTC system will depend on the introduction, by KNR, of: (a) timely and appropriate training of concerned personnel; and (b) adequate maintenance of the computer system and related software.

Findings and Lessons Learned

There were a number of findings and lessons which resulted from this project. These include lessons arising from the introduction of computerized technology into a traditional organization, and the reinforcement of past lessons learned concerning ways to increase the profitability of institutions like railroads. These lessons are:

(a) As projects introduce advanced technology and computerized systems, the appropriateness of staff skills and institutional commitments become critical, both in the Bank and in the recipient institution. As a result, the projects need to be designed very thoroughly and be well adapted to the recipient's capabilities in implementation as well as ensuring future sustainability;

(b) As agencies begin to invest in and implement advanced computerized systems, their capacity to absorb the new technology into daily operations should be reviewed carefully. The capabilities of the staff responsible for operating the systems, and those responsible for using the information generated need to be carefully assessed, and an appropriate action program developed to introduce the required expertise. Training programs need to be provided by qualified experts who would not only train personnel (both staff and management), but also reinforce the need and usefulness of the systems. In addition maintenance contracts for the hardware and software should be included in the project scope to supplement capabilities, and ensure reasonable attention to system needs beyond project completion;

(c) As projects become more computer oriented and technology more sophisticated, project teams need to include an appropriate level of expertise concerning system hardware and software so that the agency can be properly advised on a number of issues including contract packaging, appropriate bid pricing and relevant training and technical assistance. For example, in instances where bid prices are significantly below project estimates, the Bank needs to monitor results carefully to ensure that low bids do not adversely impact project implementation, and that technical assistance and training relates directly to the operation and maintenance of equipment concerned;

(d) Domestic rail computer capabilities in Korea are still in an embryonic stage of development, and for this reason there remains the need to employ foreign expertise with local participation encouraged until an adequate level of competence can be developed;

(e) Tariff increases are often difficult to achieve because of the strong social and political pressures against them. Therefore, care must be taken to ensure that all other options have been properly addressed before tariff increases are proposed. The measures that must be addressed include operational improvements to reduce

per unit operating costs, marketing efforts to identify markets where the entity has a comparative advantage, service improvements to increase the volume of existing services, reduction of uneconomic services and operations, and proper compensation from the government for non-commercial services provided at the request of the government.

KOREA
SEOUL-BUSAN CORRIDOR PROJECT (LOAN 2600-KO)
PROJECT COMPLETION REPORT

PART I: BANK'S REVIEW

1. Summary Project Data

Project Name	: Seoul - Busan Corridor Project		
Loan Number	: 2600 - KO		
RVP Unit	: East Asia	Loan Amount	: US$ 67.0M
Country	: Korea	Canceled Amount	: US$ 34.1M
Sector	: Transport	Disbursed Amount	: US$ 32.9M
Subsector	: Railways		
Approval Date	: 7/02/85	Staff Appraisal	: Feb. 1985
Effective Date	: 7/20/85	Amendment Date	: Nov. 1986
Completion Date	: 12/31/92	Total Project Cost	: US$178.3M
Loan Extension	: 3 years		
Appraisal ERR	: 41%	Re-assessed ERR	: 50%
Revised ERR	: 50%		

2. Background and Sectoral Information

Appraisal Context

2.1 In 1985, when the Seoul-Busan Corridor Project was appraised, the population of Korea was about 40 million. Almost 60% of this population lived in urban areas and per capita income was almost US$2000. Income nearly tripled in the period 1984-92 and although the population is projected to grow at less than 1% in the period 1993-2001 (presently it is 43 million), urban growth is expected to continue at a much faster rate (about 3% annually).

2.2 Throughout much of the years preceding the project, the transport system had been strained by the demands of rapid growth. To alleviate the situation, significant public investments in infrastructure were made (15% of annual capital expenditure between 1977-86; and 12% between 1987-91). Railroad investments concentrated in the Seoul-Busan axis where most of the industrial development has taken place. In the early 1980s rail freight accounted for about 40% of total ton-km, road accounting for 23% and coastal shipping 37%. The rail share of passenger-km accounted for 22% of passenger movement and road 76%. By 1991 rail share in freight movement declined to 29% and road to 21%, while coastal shipping and air carriage shares rose to 50% of total freight ton km. In passenger movement the railroad recaptured some of its lost traffic, increasing its share to over 26%, while the road share decreased to about 69%.

Seoul-Busan Corridor

2.3 The Seoul-Busan Corridor contains some of the largest urban areas in Korea; Seoul, Busan, Daegu, and Daejon. In 1985 the population of these cities totaled 16 million, growing to almost 23 million in 1991. Together with a number of smaller towns, these urban centers now account for over 50% of Korea's population (compared to 40% in 1985) and 80% of the country's GNP (in 1985 it was 70%).

2.4 At the one end of the Seoul-Busan Corridor is located the national capital, Seoul. As of December 1991, 24.5% of the national population lived in Seoul with a per capita income of almost US$6500. The increased income levels have led to tremendous increases in mobility, with the city taking various actions to re-direct growth south, to the Seoul-Busan Corridor.

2.5 In 1985 the population of the city of Busan was 3.5 million and although growth has been slow (4 million in 1991), city size has increased substantially. This is due in part to the Port of Busan which is physically located within the city and has become Korea's main container port. Thirty-six percent of this container traffic remains in the Busan area, but over 50% moves to Seoul and its environs, and 12% to Daegu or Daejon through the Seoul-Busan Corridor. About 28% of this traffic presently moves by rail on the Kyongbu Line, although it is projected that by the year 2001 this could increase significantly.

2.6 The Kyongbu Line is 445 km long, and with the exception of the section from Seoul to Suweon (about 30 km) where there are four tracks, the line is double tracked and is not electrified. South of Suweon the signalling system in existence in 1985 required that the headway vary from between 6.6 and 13.2 minutes depending on the type of trains. The number of accidents due to system failures was low due to the strict safety precautions, but the failures disrupted the smooth running of the trains and created delays which reduced the capacity of the line. The line was approaching capacity on most sections when the project was appraised and the average speeds, especially of freight trains, were declining steadily due to the requirements of the freight trains to move to passing loops to allow the faster passenger trains to pass. Increasing the capacity of this line was critical if this vital region of the country was to continue to function efficiently.

3. Previous Bank Involvement

3.1 Since 1962, the Bank Group has assisted KNR through eight projects railroad projects amounting to US$501 million, and one multi-modal (railroad/port) project amounting to US$54.03 million. The Bank has traditionally made sector type loans for the railroad, financing time-slices of KNR's investment plans, and has maintained an active dialogue on KNR's financial situation, investment plans, and level and structure of tariffs. Bank-supported investments have concentrated on improved capacity and service for long distance passenger and bulk cargo transport.

3.2 The Project Preparation Audit Report (PPAR-#10777), dated June, 1992, prepared for the Sixth and Seventh Railway Projects (Lns 1542 and 1836-KO), and the Coal and Cement Distribution Project (Ln 2267-KO), outlines some of the mixed results of Bank involvement in the sector. Although physically all objectives were met, achievement of broader objectives (institutional) was less successful:

(a) Insofar as modern business techniques are concerned, the Bank did facilitate their introduction into KNR, but since KNR as a whole continues to function as a government agency, benefits were not what they could have been; and

(b) Bank scrutiny of KNR's Investment Plans did help eliminate, or postpone, certain proposals of dubious economic merit. But in the case of more politically sponsored investments Bank advice had little effect. Still, the Bank did succeed in getting the government to reimburse KNR for capital costs incurred for economically unjustified projects.

3.3 Transforming KNR into a competitive carrier, and granting KNR managerial and financial autonomy were not, as events have shown, top Korean priorities. Cultural and political realities made it difficult for the government to share the Bank's views concerning benefits from free competition, reduction in staff, and rate and tariff increases that would affect millions of passengers and industrial entities.

3.4 The Project Completion Report (PCR) prepared for the Coal and Cement Distribution Project (Report #8265) outlined some specific findings and lessons which are particularly reflective of the present review. These include the following:

(a) Flexibility in project design is a key ingredient to successful implementation; the Coal and Cement Project was downsized due to changes in the market conditions and this change was a significant factor in the ultimate success of the project;

(b) Cost-under-runs in civil works and equipment have become somewhat of an issue in Bank projects in Korea where international costs do not tend to accurately reflect project costs; this has resulted in significant loan cancellations totaling US$138.41 million between 1985 and 1988 alone in four transport projects and the Coal and Cement Distribution Project; it has become apparent that project costs in Korea should reflect more accurately local conditions; and

(c) Implementation of regular tariff increases and the introduction of a cost-based tariff system to enable an organization to recover the cost of its operations remains difficult to implement for social and political reasons. Experience with recent railroad projects, to include the Coal and Cement and this project, suggests that efforts should be first directed at working with the institution to assist them in reducing operating costs and expanding markets where the railroad has a comparative advantage over other modes of

transportation. Only after these efforts have reduced per unit operating costs should tariff increases be considered as a means to increase profitability.

4. Follow-on Initiatives

4.1 In September, 1991, a Bank mission appraised the Railroad Systems Modernization Project. The objectives of that project were to: (a) assist KNR during its conversion to a Government Invested Enterprise (GIE); (b) improve the management and operation of KNR by introducing improved management procedures and the use of modern computerized railroad operating and management information systems; (c) enhance the level of service and related capacity for freight movements through operational improvements and better intermodal integration; and (d) support the expansion of the Seoul suburban passenger system. However, in September of 1992, the Bank decided to postpone further the processing of the project because of the Government's decision to delay the conversion of KNR to a GIE.

5. The Project

Objectives

5.1 In the autumn of 1984, the GOK requested Bank assistance to finance the re-signaling of the Kyongbu railway line in the Seoul-Busan Corridor. This project arose out of the study: Review of Long-Term Investment Needs in the Seoul-Busan Corridor, which was financed by the Bank under the Seventh Railway Project (1836-KO). The project was therein assigned the highest priority, insofar as it was expected to make a significant contribution to the safety of operations, provide increased capacity to the existing line, postpone other more costly investments, and make a direct contribution to GOK's overall plan for increasing transport capacity on this corridor. In addition, the project gave the Bank the opportunity to pursue a dialogue with the Government and KNR on institutional strengthening, multi-modal transport planning, and the longer term investment program planned for the Corridor.

Description

5.2 The project formed part of KNR's Management Improvement Program (MIP) for the development of rail traffic in the Seoul-Busan Corridor, which was designed to reduce losses incurred for ordinary train services and decrease the unit cost of profitable services. The program comprised: (a) institutional and policy measures aimed mainly at ensuring KNR's long-term viability; (b) measures to improve intermodal complementarity and railway competitiveness; and (c) investments in track signaling to increase capacity as well as investments in related rolling stock and equipment. The Bank's portion of the project included funds to finance investments only for part (c), together with associated technical assistance and training. KNR and the Government funded the other investments. (see Annex 1).

5.3 The original scope of the Bank project included: (a) re-signaling of the Seoul-Busan double-track line between Suweon and Daegu (approximately 290 km); (b) installation of a CTC system that would increase capacity to 170 trains per day; and (c) power supply and communication systems as well as train indicators, buildings, supervision and training. A CTC already existed between Seoul and Suweon, and between Daegu and Busan the signaling system had recently been upgraded. By installing the new system, the block length was to be reduced significantly from 2 km to 0.6 km, thus providing substantial capacity increase by allowing for a reduction of the interval between trains. The procurement of rolling stock, equipment and material to increase the number of trains in the Corridor were also part of the project, although financed by the Government.

Design and Organization

5.4 The project was well designed to attain its objectives. The Corridor's capacity had been seriously constrained by an outmoded signaling system along a corridor that required additional trains to support the increasing traffic demand, both passenger and freight. It became apparent that additional investments in rolling stock and motive power, roadway improvements and station facilities could not be adequately utilized without a modern signaling system. Re-signaling, with the addition of computer aided CTC was, therefore, the next logical step to increase capacity.

5.5 The institutional design and organization of the project focused on KNR's well established programs of operational and administrative improvements goals, while the main focus of KNR's MIP was aimed at developing future rail traffic along the Seoul-Busan Corridor. This program is discussed in more detail in Annex 1.

Revisions and Amendments

5.6 In July 1986, the Ministry of Finance (MOF) requested that the Bank cancel US$32.4 million of the loan. This was due to savings in procurement of the signaling and communications components. At the same time it requested that the Bank extend the scope of the project to include: (a) the upgrading of signaling in the southern part of the corridor between Daegu and Busan (US$10.4 million), and (b) the purchase of two container cranes (US$0.9 million) to handle the additional container traffic on the corridor resulting from operational improvements under the Pusan Port Project (Ln 2726-KO). This US$0.9 million was later re-allocated to the signaling component. The highly competitive bidding of the Korean suppliers and an agreement reached with the Ministry of Transportation (MOT), to use some of its communication channels on very concessional terms rather than laying its own signaling cable, allowed KNR to seek extension of the project. The savings due to aggressive bidding by Korean firms is not surprising as it has occurred in many of the Bank's other Korean transport projects.

5.7 With agreement reached to implement the Pusan Port Project (Ln 2726-KO), which would contribute to a further increase in both container and total traffic by rail along the Seoul-Busan corridor, the upgrading of the signaling system for the entire line became more urgent. Extending the contract for

provision of signaling equipment to cover the extension of the scope of the project was expected to provide additional benefits in terms of: (a) time saving; (b) increased efficiency of operation and maintenance by standardizing equipment on the entire line; and (c) elimination of the extra cost of interface equipment which would otherwise be needed to make two different systems operationally compatible. As a result, the project was extended for two years, to December 31, 1991. A second extension to December 31, 1992 was requested due to problems encountered with the cables and software (para.6.1).

6. Project Implementation

Procurement

6.1 With two exceptions, implementation was routine. Local suppliers were able to substantially under-bid the world market with resulting savings which made the expansion of the CTC re-signaling component possible. In addition, a shipment of defective cable, which had to be re-manufactured, and problems with software, caused an additional one year delay. As a consequence, closing of the loan was extended by three years, from December 31, 1989 to December 31, 1992.

6.2 Procurement was implemented without serious problems, but it appears that both KNR and the Bank should have detailed more extensively the circumstances associated with the large variance in bid prices as compared to original estimates. Although it does not appear that the quality of the system installed was compromised by the low bids, problems associated with software installation may be indirectly related to the low price, by having cut into the contractor's allocation of resources for training and technical assistance for the computer system.

6.3 All procurement was executed following International Competitive Bidding (ICB), with both domestic and foreign suppliers participating in the bidding. The main suppliers were domestic with one sub-contracted foreign supplier. Procurement of equipment was subject to ICB in accordance with Bank guidelines for procurement, except for a number of small items worth less than US$200,000 per order and totaling less than US$3 million. These were purchased on the basis of quotations received from three potential suppliers. All packages for equipment above US$100,000 were subject to the Bank's prior review of procurement documentation. In bid evaluation for equipment contracts to be let through ICB, Korean manufacturers were allowed a preferential margin of 15% of the CIF cost of competing imports, or the relevant prevailing level of customs duties, whichever was lower. For items not financed by the Bank, Government procurement procedures applied.

Costs

6.4 The total project cost, at appraisal, was estimated at US$ 178.3 million, with equipment to be procured under ICB estimated at US$ 64.0 million, and local procurement of equipment and services estimated at US$ 114.3 million. SAR price estimates for the signaling component were based on world market prices at the time. Local suppliers were, however, able to bid considerably below that because of several factors which were not apparent at appraisal. These included a recession in the Korean electrical industry which developed after appraisal,

and a concerted effort on the part of local suppliers to break into this railway signal supply market. As a result, project costs were slashed through aggressive bidding which culminated in a large loan cancellation, of US$ 32.4 million, with actual costs totaling US$ 73.8 million. Notwithstanding this, the Bank's policy at the time dictated use of world market pricing for appraisal estimates, even though similar problems had been experienced in other projects.

Consulting Services/Technical Assistance/Training

6.5 There were no consulting services as such, but there was a considerable element of technical assistance and training associated with the installation of the CTC, its computer aided control system and the MIP. All parties (KNR, contractors, and the Bank) encountered some unexpected difficulties, but in the end, the technical assistance was reasonably effective. The problem with the CTC technical assistance was largely a result of inadequate language interface between the two contractors and KNR and a lack of railway expertise of the prime contractor. In addition to the CTC technical assistance, some training of higher management was carried out with World Bank and North American Railway Industry assistance. This training focused on top level marketing and management technology, such as intermodal and bulk cargo marketing strategies, rate structure policies, and computer aided management information systems, as a tool for efficient operations. The KNR Administrator and several associates took part in two separate visits to several railway management organizations in the U.S. Several of the management and operations techniques discussed during the training periods were modified to fit the KNR situation and were later implemented with success.

7. Project Results and Lessons Learned

7.1 Overall the project has been a success. All physical targets were met and indeed exceeded. Although there were project delays in implementation, the delays which occurred were, by and large, beyond the control of KNR. The first delay related to the extended scope of the project and the second to technical difficulties.

7.2 The MIP, of which the Seoul-Busan Corridor Project was a part, was also successfully implemented. It was designed to reduce losses incurred for ordinary train services as well as to improve other readily profitable services by decreasing the unit cost of services offered. The results have been good. In total 216 ordinary trains have been discontinued; two unprofitable lines (57.5 km) closed; 31 stations downgraded; passenger trains' top speeds increased from 120 kph to 140 kph; and frequency of passenger trains on the corridor increased to one every 15 minutes from one every 30 minutes. In addition, the additional capacity on the Line has permitted large increases in freight moved along the Corridor which is best illustrated by the movements of containers which has gone from 883,000 tons in 1985 to about 3,500,000 tons in 1991.

Financial

7.3 Tariffs were raised 10% and 12% in 1991 and 1992 respectively. These were the first tariff increases since May 1985, and while the rates do not fully compensate KNR for some of its services (fourth class passengers and coal), the

rates for other services exceed the long run variable cost to provide the services. Despite this real decline in average tariffs, KNR currently has a positive contribution margin for most of its services due to the fact that it has been able to reduce the per unit operating costs for both passenger and freight services. These operating cost savings are due primarily to large volume increases but also to management's efforts to control the operating expenditures.

7.4 As indicated above, two major services provided by KNR (fourth class passenger and coal) are provided at rates that do not compensate KNR for the long run variable cost to provide the service, and since the government does not fully compensate the railroad for providing these non-commercial services, KNR is obligated to cross subsidize these services with the profits generated from other services. Despite this problem, KNR is still one of the most profitable railroads in the world. Since there were no tariff increases between 1985 and 1991, KNR's revenue growth during this period was due to increases in volume of both passengers and freight and to a shift from non-commercial passenger services (fourth class) to commercial ones. From 1985 and 1991, the number of first and second class passenger km provided increased at an average annual rate of 9.1% (compared to the forecasted annual increase of 6%), and the number of non-commercial (fourth class) passenger km provided decreased at an average annual decrease in services of 14.2%. In addition, over this same period, the total number of freight ton km increased at an average annual rate of 2.5%.

7.5 Despite KNR's strong results of operations over the last several years, the project's financial covenants were generally not met. This unsatisfactory performance in realizing the required rate of return on operating fixed assets and in maintaining the agreed upon current ratio is due to the government not properly compensating KNR for providing non-commercial services. The MIP intended to address this profitability issue through tariff increases, however experience with this and other railroad projects suggests that it may have been more useful to assist KNR to further reduce its operating costs and expand its markets in order to increase its profitability. In addition, more efforts should have been directed at having the government begin to fully compensate KNR for the non-commercial services provided.

Economic

7.6 At the time of appraisal express passenger traffic (classes 1-3) on the Kyongbu Line was assumed to grow at an overall constant 7% per annum and freight traffic at 3%. These estimates appear to have been relatively conservative with regard to passenger traffic which in fact grew at an annual average rate of 10.5% from 1984 to 1991, and the growth for the period 1992 to 1997 is now projected to reach 15%. The projections of growth in freight traffic were more accurate, but here the 3% annual average growth rate does not reflect the change in the mix from coal to container and other high value cargos.

7.7 For comparative purposes the economic re-evaluation was based on the same methodology as outlined in the SAR, with benefits measured only for passenger traffic. The project benefits have been calculated in terms of consumer surplus, or travelers' "willingness to pay" for express rail services over that offered by road, specifically buses. The benefits have been calculated as the

difference between that paid for the bus service and the express trains. In the SAR, a benefit of 6 won per passenger (constant for the project life) was assumed, while in actual fact the benefit has increased steadily reaching 7.5 won per passenger in 1991. The resultant re-evaluated economic internal rate of return (EIRR) is estimated at 48% for the signaling component, and 59% for the CTC component, with an overall weighted EIRR of 50%. This compares to an appraisal estimate of 39% for signaling and 47% for CTC, with an overall return of 41%. The revised EIRR (prepared as a result of project revisions and amendments) was estimated at a composite 50%, which is consistent with the re-evaluated estimate prepared for the PCR. (The benefits of the project have been apportioned one-third/two thirds between the CTC and the signalling components).

Findings and Lessons Learned

7.8 The project reflects a mix of findings and lessons which underline issues arising from the introduction of modern technology into a somewhat traditional and conservative organization, and the reinforcement of past lessons learned concerning ways to increase the profitability of institutions like railroads. These lessons are:

(a) Projects which introduce advanced technology and computerized systems need to be designed differently from those which finance more traditional investments. As components become more sophisticated and complex, the appropriateness of staff skills and institutional commitments become critical, both in the Bank and in the recipient institution. As a result project design needs to be very thorough and well adapted to recipient capabilities in implementation as well as ensuring future sustainability; and

(b) Tariff increases are often difficult to achieve because of the strong social and political pressures against them. Therefore, care must be taken to ensure that all other options have been properly addressed before tariff increases are proposed. The measures that must be addressed include operational improvements to reduce per unit operating costs, marketing efforts to identify markets where the entity has a comparative advantage, service improvements to increase the volume of existing services, reduction of uneconomic services and operations, and proper compensation from the government for non-commercial services provided at the request of the government. Experience with this and other railroad projects in Korea and other countries highlights the need for the Bank to promote all possible efforts to increase the efficiency of the transportation system and to reduce the total transportation cost to the country. Tariff increases can play an important role in this process, but they should be one of many tools and should not be looked upon as the primary means of addressing an institution's profitability problems.

7.9 More specifically, project-wise, problems encountered in implementing the advanced technology for the CTC system also offered some useful insights:

(a) As agencies begin to invest in advanced computerized systems, their capacity to absorb the new technology into daily operations should be reviewed carefully. The capabilities of the staff responsible for operating the systems, and those responsible for using the information generated need to be carefully assessed, and an appropriate action program developed to introduce the required expertise. Training programs need to be provided by qualified experts who would not only train personnel (both staff and management), but also reinforce the need and usefulness of the systems. In addition maintenance contracts for the hardware and software should be included in the project scope to supplement capabilities, and ensure reasonable attention to system needs beyond project completion;

(b) KNR does not yet employ a sufficient number of adequately trained personnel who can deal with the maintenance of computer hardware and software to accommodate changing conditions. Based on the experience of this project, domestic rail computer capabilities are still in an embryonic stage of development, and for this reason there remains the need to employ foreign expertise with local participation encouraged until an adequate level of competence can be developed; and

(c) Arrangements for follow-up technical assistance from the foreign supplier, to ensure successful operation, should be a part of the initial contract. Such arrangements should focus on teaching KNR staff to be self sufficient with respect to software maintenance and improvements. A major consideration in contracting for such high technology transfer should be the requirement that the foreign supplier and local counterparts must have to be fully versed in the local language. The lack of language skills by the suppliers in this case was one of the primary reasons for the software problems which arose.

8. Sustainability/Remaining Issues

8.1 The Seoul-Busan Corridor has provided Korea with a significant challenge in coping with transport demand for almost two decades. The problems have been further exacerbated by KNR's tendency to focus on relatively short range planning which is neither strategic in nature nor geared to its competitive environment. The Project did, however, introduce advanced technology to KNR and increase the railroad's operating efficiency. The follow-on project, Railroad Systems Modernization (para.4.1), now suspended, would have complemented this work and helped KNR adapt more to the introduction of modern technologies.

8.2 Overall, the project is considered to be sustainable. However there are a number of issues of concern for the short-term. These include: (a) maintenance of the computer system and related software, and (b) appropriate and timely training of concerned personnel.

8.3 The investment portions of the project which involved standard, well established technology - the signaling component - are expected to be adequately

maintained and the improvements brought about by its installation will likely be sustained and built upon in the years to come. However, that associated with the advanced technology utilized in the computer aided CTC is more questionable.

8.4 Although software testing at the Busan CTC Center began in August 1992 and continued until near project closing, problems were encountered with several aspects which prevented a switch-over from manual to automatic mode. These included: (a) slow switch-over from the main computer to back-up if the main computer failed; (b) failure to register and remember some train tracking input from the older Seoul computer system; and (c) bugs in some of the graphic display programs. The first two would have had a serious impact on the effectiveness of the system unless corrective action was taken. Following a recommendation from the Bank's PCR mission, KNR, the prime contractor, and foreign sub-contractor met in Seoul with Bank mission members to work out a revised work schedule to ensure that outstanding problems were solved and installation completed by November 30, 1992 (30 days before project closing). The mission recommended that KNR take an active role in supervising the revised work schedule. KNR agreed to take on this role and instituted weekly meetings to monitor progress. The result has been successful, but underlines a basic problem KNR has in dealing with issues which are not clearly understood by them, or have been delegated to others; as well as demonstrating the fact that introducing a cooperative environment, where activities are coordinated, is an effort for KNR. There is, therefore, an undeniable need for some expert technical assistance from a qualified supplier to assist with the hardware and software maintenance as well as associated training of KNR personnel, over a reasonable period to ensure sustainability of the project. The existing problems with the system software are made more difficult to deal with because KNR staff do not yet have sufficient technical skills to operate and maintain the system in the required state of readiness. The project plan envisaged a one year extended maintenance and training program to deal with this aspect, but this program was not in place in time to accommodate the need. In projects involving high technology, the Bank should remain involved to assist the agency to adjust to the new systems and procedures to ensure that the benefits obtained from the new technology are sustained.

9. Bank Performance

9.1 The overall success of the project can be attributed in part to the good performance by Bank staff during the entire project cycle. Supervision teams were sent to Korea on a regular basis and staff changes were kept to a minimum, thus enabling good relationships to be built up over the period of project implementation. The exceptions to this good performance include: (a) assistance should have been provided to the borrower in pricing and reviewing the bids for the technology components; and (b) the management performance goals, while needed, were set on unrealistic time schedules.

9.2 There was in fact one lesson which is specifically applicable to the Bank and which is worth noting:

As projects become more computer oriented and technology more sophisticated, project teams need to include an appropriate level of expertise concerning system hardware and software so that the agency can be properly

advised on a number of issues including contract packaging, appropriate bid pricing and relevant training and technical assistance. For example, in instances where bid prices are significantly below project estimates, the Bank needs to monitor results carefully to ensure that low bids do not adversely impact project implementation, and that technical assistance and training relates directly to the operation and maintenance of equipment concerned.

10. Borrower Performance

10.1 Overall performance of KNR was satisfactory. The Signaling Division, responsible for the CTC component, implemented the project with the International Co-operation Division responsible for administrative affairs. Most of the important project components were carried out without incident. Problems which arose were considered part of the normal learning curve related to the installation of a new system. The only area of concern related to the software where there were delays in achieving a useful functioning level. Instead of attacking the issue aggressively in its infancy KNR allowed it to fester until it reached such proportion that drastic action was necessary. These problems were not resolved until near closing.

10.2 The project introduced KNR to a new system with which they were unfamiliar. Yet, beyond the provision in the loan for training of personnel, KNR did not look to organize any additional relevant in-house training program themselves. It was instead left rather loose with a general assumption that with the system in place, and some key personnel trained, all would be solved. Secondly, KNR did not appear to recognize the importance of setting up a formal maintenance program for either the hardware or software associated with the project. It was only after Bank recommendation that they considered possible options.

10.3 Finally, it was not until the Korean Board of Auditors (BOA) flagged the problem respecting adequate functioning of the project software that KNR appeared to become fully aware of the magnitude of the issue. The BOA identified the fact that the software was not functioning properly and instructed KNR to rectify the situation. Lack of knowledge concerning the systems and software appears to have been a key factor. Although a number of staff had been trained, English competency prevented them from learning as much as they would have otherwise. Also it is not certain that the appropriate type of staff were invited to attend the training courses.

11. Project Relationships

11.1 The parties involved in all phases of the project got along well with the resultant success of the undertaking. KNR's staff at all levels are well informed on railway operations matters and their top officers are professional managers with good insight into the workings of a large enterprise such as KNR. The other Government officials who were at one time or another involved in project planning and implementation were also quite professional. Bank staff for the project were well regarded in their fields and had a genuine interest in KNR development. Both groups were quick to develop a mutual respect, which made the project run smoothly.

11.2 Where there was an obvious problem in relationships was that between KNR and its signaling suppliers. The software, when first introduced appeared to have problems and be somewhat incompatible with the overall system. Instead of meeting the concerned parties at a decision-making level to rectify the situation and come to an appropriate solution, KNR allowed the issue to escalate to serious proportions. Had KNR met with concerned parties in a timely manner and discussed the issues as they arose, the problems would not have escalated to the degree that they eventually did.

12. Project Documentation and Data

12.1 The staff appraisal report provided a useful reference framework during the implementation of the project.

12.2 KNR has kept good records of the project, which assisted the Bank in its preparation of the project completion report.

PART II: BORROWER'S EVALUATION

A. Conditions Leading to the Project

A.1 In 1985, at the time of project appraisal, the present rail system was in such a state of deterioration that line capacity would gradually be reduced. The railroad's Kyongbu line was already beginning to lose significant traffic to the roads. System failures were more than was acceptable, being 1000/year and the system under consideration was under manual operation which impacted the capacity of the line. The option to simply overhaul the line was estimated to cost about 80% of that projected for the project and it was determined that it was time the railroad entered the automatic age, an action which was expected would allow for increased train speeds and increase line capacity significantly.

B. Main Findings and Lessons Learned

B.1 The main findings and lessons learned include the following:

(a) KNR has learned, through the project the most appropriate way to design and implement rail projects. It has also given them the insight into appraisal techniques, which they have modified for their own analyses;

(b) It is very difficult for KNR to prepare specifications in English finding it particularly painful to determine the appropriate level of detail necessary when dealing with ICB. In their experience different levels of detail appear to be necessary for different countries competing. Whereas, some are very familiar with Korean ways and as a result require less direction, others appear to be very unfamiliar, resulting in a level of detail which in normal circumstances they would not include. Given limited knowledge in some areas, which is the very reason for assistance, it is particularly difficult for KNR to be articulate. One possible solution would be to include, in prospective proposals an insistence on a certain functional level of knowledge of the Korean language by participating agencies, whether they be in-house or additional;

(c) Although Koreans prefer to work on the basis general agreement, either verbal or written, it was found that in certain cases (i.e. certain countries) such a flexible approach invited catastrophic results, because it appeared to be too open to interpretation;

(d) The advanced computer technology has met with KNR expectations, regardless of the issues which have arisen and the problems which have been identified; and

(e) The problems which KNR has had with the contractors have made them re-think the way they would implement future projects of this nature. In this project various components were procured under separate contract, which resulted in some incompatibility of supplies. In future KNR would go for a turn-key type of operation, with a central contractor responsible for delivery of a package. Nonetheless, local firms were able to develop more expertise in the area of computers, and as a result successfully introduced them into new areas of activity.

C. Summary of Bank Role and Performance

C.1 Bank performance was satisfactory. There was close co-operation between KNR and the Bank. As a result the scope of the project was extended without any problem, as was the scope of the training program. With project re-scoping KNR was able to fully utilize funds available, because the Bank acted not only quickly in re-allocation, but also because they allowed the extension of the closing dates to facilitate disbursal. Supervision was very good with proper frequency and adequate number and type of expertise.

D. Evaluation of Borrower's Own Performance

D.1 Overall performance of KNR was satisfactory, with project implementation proceeding more or less according to schedule. The two delays which occurred were outside KNR's realm of control, the first being the extended scope of the project and the second relating to technical difficulties. The Signaling Division of KNR carried out its responsibilities well without any major problems.

D.2 At the time that KNR became interested in introducing an appropriate system for signaling, they compared the different systems available in the U.S., Germany and Japan. In their investigation it was found that the German and Japanese systems (Auto Train Control-ATC) were more similar to the Korean way of running trains. However, the systems used by those two countries were still in an embryonic stage of development, while the American system CTC already had a proven capability. In the future KNR does plan to go for the ATC system, and plans to install it in the new Seoul Metropolitan Electrified Suburban Railway System (SMESRS) lines being constructed (Bungdang and Kwacheon). The two levels of technology are considered to be compatible with both using the control center provided by this project.

D.3 With the installation of the new system under this project, KNR will be able to produce more complicated statistics, and will be in a much better position to more fully analyze and evaluate train performance more scientifically and precisely. It should prove to be a very helpful instrument in planning operations.

E. Remaining Issues

E.1 There are two issues to be resolved; the first concerns software, and the second maintenance of the hardware and software system. It is however anticipated that both issues will be resolved within the next few months.

KNR Management Improvement Program

1. KNR has for some time, had in place a Management Improvement Program (MIP) as a means of guiding management decisions to attain short term as well as long term goals of providing improved public service. The Seoul-Busan Corridor Project formed a part of the program - the development of rail traffic in the Seoul-Busan corridor. The program was designed to reduce losses incurred for ordinary train services as well as to improve other already profitable services by reducing the unit cost of services offered. The program comprised: (a) institutional and policy measures aimed mainly at ensuring KNR's long-term viability; (b) measures to improve intermodal complementarity and railway competitiveness; and (c) investments in track signaling to increase capacity and in related rolling stock/equipment in line with transport demand. The Bank project only included funds to finance investments for a portion of (c) together with associated technical assistance and training. KNR and the Government funded the other investments.

2. Results of the MIP were quite good. Where KNR had full control of the decision process, results, for the most part, were better than expected and in those cases where EPB and other Government agencies were involved, the results were reasonably good, even though the timing was slower than anticipated at project appraisal. Results of the program are discussed in the following brief detail:

(a) Short term (1985-1986)

(i) The further discontinuation of ordinary (Bidulgi & other) trains in 1985;

14 such trains were discontinued in 1985. In addition, 202 Bidulgi trains were discontinued from 1985 to the end of 1991.

(ii) the closure of one uneconomic line and the conversion to private sidings of two others;

two unprofitable lines totaling 57.5 km were closed by January 20, 1990.

(iii) the downgrading of fifteen full service railway stations into "simple stations";

31 stations were downgraded from 1985 to 1991.

(iv) an increase in the Seoul-Pusan Corridor speed from 120 kph to 130 kph, and also in the number of air-conditioned coaches to improve service to passengers;

this speed has been increased to 140 kph as a result of the CTC and re-signaling supported by the project and air-conditioned car for first class service increased from 170 in 1986 to 221 in 1991.

(v) an increase in passenger train frequency by decreasing train interval from 30 minutes to 20 minutes;

the frequency of passenger trains on the corridor has been increased to one each 15 minutes.

(vi) seeking EPB approval for 1985 tariff increases on freight service and passenger services (5%), and the introduction of flexible (volume dependent) freight tariffs.

KNR was unable to get Government's approval to increase tariffs until December 1990 and again in July 1992. These increases were allocated as follows:

Service	1990 increase - %	1991 increase - %
Saemaul	15.0	17.7
Mugunghwa	8.0	12.0
Tongil	8.0	8.0
Bidulgi	8.0	8.0
Freight	15.0	7.0

(b) In the longer term (two to five years)

(vii) the formation of joint ventures with publicly held real estate development companies to rebuild 4 major stations (Seoul, Daejon, Daegu and Yongsan) as commercial centers;

Through joint venture arrangements with private developers, KNR was able to modernize three major stations: Seoul, open March 1989; Tonginchon, which opened April 1989; and Youngdeungpo which opened May, 1991. Six other stations are under reconstruction or planned for opening in 1995 through 1996. They are: Pupyong, Puchon, Chongryangri, Daegu, Daejeon, and Wangsibri.

(viii) the introduction of feeder bus and car rental services, to enable KNR to provide a more complete service and improve KNR's competitiveness in relation to bus transport;

Rental car service was made available from private companies by KNR beginning in 1986 and as of September 1992, the service was available at 35 stations. No feeder bus service is yet available.

(ix) marketing container services, pickup and delivery of freight parcels;

Much progress has been made in container marketing and operations which can best be described by the table below:

CONTAINER TRAFFIC GROWTH 1986 - 1991 (thousand TEU)

Year Total Containers	1986	1987	1988	1989	1990	1991
Received in Pusan	1,393	1,796	2,104	2,175	2,228	2,363
Shipped Via Rail	147	199	233	248	307	329
Rail Share (%)	10.6	11.1	11.6	11.4	13.7	13.8
Total Trains Daily						24

(x) further reductions in staff through automatic fare collection systems and central traffic control systems.

Total personnel has declined in recent years, from 38,111 in 1989 to 37,882 in 1992. During this period, productivity has risen from 368 units for freight and 682 for passenger to 383 and 887 respectively in 1992. When compared to some of the European railroads, the results are mixed as indicated below:

	KNR	FRANCE	GR. BRITAIN	W. GERMANY
Traffic Units Per Employee [000]	1,040	537	350	397
Employees Per Km of Line	11.9	6.7	9.0	9.2

Part III - KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 1: Related Bank Loans and/or Credits

Loan/Credit	Purpose	Year of Approval	Status	Comments
Railroad Project, Credit 25-KO	To assist in financing a significant part of the Korean National Railroad's (KNR) first Five Year Development Program (1962-66) through procurement of 115 passenger cars and 800 coal cars and the services of foreign consultants to assist in the establishment of a modern accounting and statistical system for KNR.	1962	Completed	PCR was not prepared.
Second Railroad Project, Credit 110-KO	To assist in financing the first three years of the Second Five Year Economic Development Plan (1967-71) through construction of new lines, increased station and line capacity, track and structure improvements, and the acquisition of motive power and rolling stock. The credit to finance the import of 600 hopper cars required to meet an unexpected increase in coal traffic by about 25% and 450 tank cars to provide for the expected doubling of the volume of oil traffic over the project period and consuting services.	1967	Completed	PCR was not prepared.
Third Railway Project, CR 183/LN 669-KO	The Project is based on KNR's proposal to expand the 1967-71 investment plan beyond that approved as a basis for Credit 110-KO. Government's plan was revised in 1968 to meet the needs brought about by the rapid pace of development and KNR also revised its investment in transport capacity to meet the growth in the economy. The project includes motive power and rolling stock, increase in station and line capacity, track renewals and improvement in telecommunications.	1969	Completed	PCR issued; PPAR No. 3034, June 1980.
Fourth Railway Project, Loan 863-KO	The Project consists of the first three years of KNR's investment plan (1972-76). To complete the already started electrification of industrial lines connecting Seoul with the north-eastern part of Korea where coal and cement industries are located; electrification of KNR lines in the Seoul suburban areas as part of the rapid transit project for Seoul Metropolitan area; construction of a new link from the Second Incheon Port to an existing railway line; installation of centralized traffic control in the Seoul area; improvement of marshalling yards and freight handling facilities; completion of track and rail renewals; bridge strengthening; procurement of track maintenance and renewal equipment; purchase of passenger and freight cars; improvement of facilities for repair of motive power and rolling stock; and installation of some telecommunications facilities.	1972	Completed	PCR issued; PPAR No. 3742, Dec. 1981.

Loan/Credit	Purpose	Year of Approval	Status	Comments
Fifth Railway Project, Loan 1101-KO	The project consists of the investments which KNR intends to make during the last two years of the Third Plan (1972-76). It consists of: (a) completion of the electrification of industrial and suburban (Seoul) lines; (b) completion of centralized traffic control in Seoul area; (c) continuation of double-tracking of the Honam line; (d) acquisition of 50 diesel and 10 electric locomotives, etc.	1974	Completed	PCR issued; PPAR No. 3742, Dec. 1981.
Sixth Railway Project, Loan 1542-KO	The project forms part of KNR's investment Plan (1977-81), and aims at providing KNR with the capacity required to meet forecast traffic. The project will enable the railways to move increasing quantities of bulk commodities and passengers on routes for which the railways remain the most economic mode of transport, thus realizing sizeable savings in transport costs to the entire economy.	1977	Completed	PCR No. 5090 of May 1984.
Seventh Railway Project, Loan 1836-KO	To increase the capacity of the transport system in the most economically efficient way and to develop and strengthen the institutions dealing with the transport sector. The main component of the project is the 1980-81 part of KNR's 1977-81 investment Plan which aims at (a) initiating the institutional changes necessary to gradually transform KNR into a public corporation; (b) providing KNR with the capacity required to meet forecast traffic; and (c) reducing operating and maintenance costs.	1979	Completed	PCR No. 6196 of May 1986.
Coal and Cement Distribution Project, Loan 2267-KO	To provide necessary capacity in rail, ports and inland terminals to efficiently handle the forecasted coal and cement traffic through the 1980s and to correct system inefficiencies in coal and cement distribution which included: (a) dealing with the complexity of the distribution system due to the fragmented coal mining and briquette industries, and the utilization of scale economies in the transportation of coal imports, and (b) reversing the habit of transporting and distributing large proportions of cement in bags rather than bulk.	1983	Completed	PCR No. 8265 of December 1989.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 2: Bank Resources

A. Staff Input

Stage of Project Cycle	Number of Staff Weeks
Through Appraisal	23.7 sw
Appraisal through Board Approval	20.0 sw
Board Approval through Effectiveness	7.2 sw
Supervision	38.5 sw
Total	89.4 sw

B. Missions

Month/Year	No. of Persons	Days in Field	Specialization	Performance Rating
Preparation: Mission data are not available.				
Supervision				
Nov. 2-13, 1987	3	6	FA/RE/PE	1
June 26-July 5, 1988	3	9	FA/EC/Consultant	1
Nov. 7-12, 1988	2	5	FA/Consultant	
Apr. 24-May 4, 1989	2	10	FA/Consultant	1
Feb. 12 - 20, 1990	3	8	FA/Consultants (2)	
Nov. 17 - 20, and Dec. 7 - 13, 1990	2	9	FA/Consultant	1
May 26-June 7, 1991	2	12	FA/TE	
PCR				
Sept. 14-Oct. 8, 1992	3	7	FA/OA/RE/EC	

FA: Financial Analyst
PE: Port Engineer
OA: Operations Analyst
RE: Railway Engineer
TE: Transport Engineer
EC: Economist

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 3: Status of Covenants

Section	Description Covenant	Comments
4.01	KNR shall provide audited financial statements for the organization and a separate opinion for the statement of expenditures by June 30 of each year.	Complied. The Bank agreed for KNR to submit reviewed financial reports, instead of fully audited reports, due to lack of information on fixed assets of KNR
4.02	KNR shall earn a rate of return on commercial services of not less than 4% (FY 85), 5% (FY 86), 5.5% (FY 87) and 6% (FY 88 and thereafter) on the average current net value of fixed assets in operation.	5.0% in FY 85 5.1% in FY 86 5.1% in FY 87 4.6% in FY 88 4.4% in FY 89 3.8% in FY 90 3.7% in FY 91 2.3% in FY 92
4.03	KNR shall maintain a ratio of current assets to current liabilities of not less than 1.5 by 12/31/88 and thereafter.	0.43 in FY 85 0.43 in FY 86 0.33 in FY 87 0.32 in FY 88 0.50 in FY 89 0.47 in FY 90 0.48 in FY 91 0.37 in FY 92
4.04	KNR shall not incur any debt, unless a reasonable forecast of the revenues and expenditures of KNR shows the estimated revenues for each fiscal year during the term of the debt to be incurred to be at least 1.1 times the estimated debt service requirements of that year.	0.81 in FY 85 1.05 in FY 86 1.17 in FY 87 1.09 in FY 88 1.07 in FY 89 1.12 in FY 90 1.07 in FY 91 0.67 in FY 92
4.05	KNR shall comply with the terms and measures, which are required to carry out the investment plan. Any substantial (50 billion won) changes in the plan will only be made with the concurrence of the Bank.	Complied.
5.02	KNR shall comply with the necessary measures to carry out the Management Improvement Program, and consult with the Bank in order to review and evaluate the progress achieved.	Substantially complied with.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 4: Cumulative Estimated and Actual Disbursements
(US$ million)

IBRD Fiscal Year	Appraisal Estimate	Formally Revised Estimate	Actual	Actual as % of Appraisal Est. (%)
December 31, 1985	0	6.02	6.02	-
June 30, 1986	2.8	6.02	6.02	215.0
December 31, 1986	12.9	9.00	9.00	69.76
June 30, 1987	23.1	12.86	12.86	55.67
December 31, 1987	30.5	15.91	15.91	52.16
June 30, 1988	38.0	22.87	22.87	60.18
December 31, 1988	52.5	22.90	22.90	43.61
June 30, 1989	67.0	25.13	25.13	37.51
December 31, 1989		27.70	27.73	-
June 30, 1990		33.40	29.92	-
December 31, 1990		33.50	31.01	-
June 30, 1991		34.16	31.26	-
September 30, 1991		34.36	31.48	-
June 30, 1992		34.60	32.15	-
December 31, 1992			32.79	-
June 30, 1993			32.94	-

Note: US$31,409,000.00 was cancelled on July 16, 1986, US$995,000 was cancelled effective September 26, 1989, and the undisbursed balance of $1,651,598.95 was cancelled effective March 11, 1993 (total cancellation $34,055.598.95).

Date of Final Disbursement: February 26, 1993

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 5A: Domestic Freight Traffic 1985-1991
(Thousand Ton)

Transport Mode	1985			1986			1987			1988		
	Ton	Share	Growth Rate (%)	Ton	Share	Growth Rate (%)	Ton	Share	Growth Rate (%)	Ton	Share	Growth Rate (%)
Railway	55,346	23.2	3.1	58,238	22.0	5.2	59,280	21.5	1.8	60,737	20.7	2.5
Road	148,699	62.5	3.5	168,779	63.8	13.5	175,281	63.6	3.9	184,559	62.9	5.3
Shipping	34,179	14.3	7.7	31,605	14.2	10.1	40,747	14.3	8.3	48,041	16.4	17.9
Aviation	68	--	17.2	78	---	14.7	93	0.0	19.2	111	0.0	19.4
TOTAL	238,292	100.0	4.0	264,721	100.0	11.1	275,403	100.0	4.0	293,448	100.00	6.0

Transport Mode	1989			1990			1991		
	Ton	Share	Growth Rate (%)	Ton	Share	Growth Rate (%)	Ton	Share	Growth Rate (%)
Railway	58,070	18.7	-3.4	57,922	17.2	-1.3	61,215	16.0	5.7
Road	199,945	63.7	8.1	215,125	64.8	7.6	245,126	64.0	13.9
Shipping	54,874	17.5	14.2	63,985	18.9	16.5	76,124	19.9	19.1
Aviation	155	0.1	39.6	184	0.1	18.1	200	0.1	9.3
TOTAL	313,644	100.0	6.9	337,145	100.0	7.5	382,665	100.0	13.5

Source: Ministry of Transportation, Statistical Yearbook, 1992.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 5B: Domestic Freight Traffic 1985-1991
(Million Ton-km)

Transport Mode	1985			1986			1987			1988		
	Ton-km	Share	Growth Rate (%)	Ton-km	Share	Growth Rate (%)	Ton-km	Share	Growth Rate (%)	Ton-km	Share	Growth Rate (%)
Railway	12,296	39.5	2.2	12,813	37.8	4.2	13,061	37.3	1.9	13,784	35.3	5.5
Road	7,008	22.8	4.5	8,034	23.7	13.7	8,376	23.9	4.3	8,645	22.1	3.2
Shipping	11,639	37.5	4.5	13,034	38.4	12.0	13,502	38.6	3.6	16,617	42.5	23.1
Aviation	25	0.1	18.2	29	0.1	11.5	36	0.1	24.1	43	0.1	19.4
TOTAL	**31,029**	**100.0**	**3.6**	**33,910**	**100.0**	**9.3**	**34,975**	**100.0**	**3.1**	**39,089**	**100.0**	**11.8**

Transport Mode	1989			1990			1991		
	Ton-km	Share	Growth Rate (%)	Ton-km	Share	Growth Rate (%)	Ton-km	Share	Growth Rate (%)
Railway	13,605	33.6	-1.3	13,663	30.9	0.4	14,494	29.1	6.1
Road	8,958	22.1	3.6	9,325	21.1	4.1	10,530	21.1	12.9
Shipping	17,852	44.1	7.4	21,127	47.8	18.3	24,737	49.6	17.1
Aviation	63	0.2	46.5	72	0.2	14.3	79	0.2	9.7
TOTAL	**40,476**	**100.0**	**3.6**	**44,187**	**100.0**	**9.2**	**49,840**	**100.0**	**12.8**

Source: Ministry of Transportation, Statistical Yearbook, 1992.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 6A: Domestic Passenger Traffic 1985-1991
(Thousand Passenger)

Transport Mode	1985			1986			1987			1988		
	Passenger	Share	Growth Rate (%)	Passenger	Share	Growth Rate (%)	Passenger	Share	Growth Rate (%)	Passenger	Share	Growth Rate (%)
Railway	503,123	4.4	2.9	513,956	4.3	3.1	525,056	4.2	1.2	564,240	4.2	7.5
Subway	325,233	2.8	53.0	330,492	3.8	78.5	649,347	5.1	11.9	799,949	6.0	21.1
Road	10,601,047	92.7	3.9	10,932,607	90.3	3.1	11,455,734	90.0	4.8	11,905,341	39.6	1.9
Shipping	3,534	0.1	-8.9	8,727	0.1	2.3	8,028	0.1	-8.0	9,838	0.1	10.1
Aviation	3,467	0.0	20.8	4,091	0.0	18.1	5,101	0.0	24.6	6,297	0.0	23.4
TOTAL	11,441,409	100.0	4.8	12,044,875	100.0	5.3	12,643,816	100.0	5.0	13,284,665	100.0	5.1

Transport Mode	1989			1990			1991		
	Passenger	Share	Growth Rate (%)	Passenger	Share	Growth Rate (%)	Passenger	Share	Growth Rate (%)
Railway	584,695	4.4	3.6	644,314	4.4	10.3	679,281	4.6	5.3
Subway	886,008	6.6	10.8	1,101,677	7.6	24.3	1,249,137	8.4	13.4
Road	11,349,830	88.9	0.4	12,721,877	87.8	6.5	12,854,212	86.8	1.0
Shipping	8,850	0.1	0.1	8,260	0.1	-6.7	8,485	0.1	2.7
Aviation	8,952	0.1	42.2	11,064	0.1	23.6	12,253	0.1	10.7
TOTAL	13,438,299	100.0	1.2	14,487,692	100.0	7.8	14,803,368	100.0	2.2

Source: Ministry of Transportation, Statistical Yearbook, 1992.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 6B: Domestic Passenger Traffic 1985-1991
(Million Passenger - km)

Transport Mode	1985			1986			1987			1988		
	Passenger - km	Share	Growth Rate (%)	Passenger - km	Share	Growth Rate (%)	Passenger - km	Share	Growth Rate (%)	Passenger - km	Share	Growth Rate (%)
Railway	22,595	21.1	3.2	23,563	20.9	4.3	24,457	21.1	25,978	25,978	21.2	6.2
Subway	4,477	4.2	93.8	7,228	6.4	61.4	7,965	6.9	8,557	8,557	7.0	7.4
Road	73,025	73.0	2.1	79,732	70.9	2.2	81,265	70.1	85,325	85,325	69.6	3.0
Shipping	570	0.5	1.9	551	0.5	-3.3	489	0.4	529	539	0.4	10.2
Aviation	1,187	1.1	16.8	1,431	1.3	21.1	1,770	1.5	2,191	2,191	1.8	23.8
TOTAL	106,849	100.0	4.6	112,505	100.0	5.3	115,946	100.0	3.1	122,590	100.00	5.7

Transport Mode	1989			1990			1991		
	Passenger - km	Share	Growth Rate (%)	Passenger - km	Share	Growth Rate (%)	Passenger - km	Share	Growth Rate (%)
Railway	27,390	21.7	5.4	28,963	21.6	5.7	33,582	24.3	15.9
Subway	9,352	3.4	9.3	11,229	8.3	20.1	11,891	8.6	5.9
Road	85,608	67.9	0.3	89,712	66.7	4.8	87,985	63.5	-1.9
Shipping	546	0.4	1.3	520	0.4	-4.8	524	0.4	0.8
Aviation	3,179	2.5	45.1	4,011	3.0	26.2	4,443	3.2	10.9
TOTAL	126,075	100.0	2.8	134,435	100.0	6.6	138,425	100.0	3.0

Source: Ministry of Transportation, Statistical Yearbook, 1992.

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Table 7: KNR Traffic: Forecast and Actual 1986 and 1991
(Millions)

	1986		1991		Growth Rate (% p.a.)	
	Forecast	Actual	Forecast	Actual	Forecast	Actual
Passenger-km						
Saemaeul	718	893	704	2,721	-0.4	25.0
Express	12,846	13,032	17,480	18,859	6.4	7.7
Ordinary	4,412	3,115	4,240	1,448	-0.8	-14.2
Commuter	n.a.	337	n.a.	167	n.a.	-13.1
Subtotal	**17,976**	**17,378**	**22,424**	**23,195**	**4.5**	**5.9**
SMESRS	7,600	6,185	10,600	10,36	6.9	10.9
Total	**25,576**	**23,563**	**33,024**	**33,582**	**5.2**	**7.3**
Ton-km	12,932	12,813	14,250	14,494	2.0	2.5

Source: KNR, Statistical Yearbook, 1986-1991.

Table 8: Total Passengers on Kyongbu Line by Section[1] (1984-1991)
(Million Passengers)

Year	Seweon-Cheonan	Cheonan-Daejon	Daejon-Dongdaegu	Dongdaegu-Busan	Total
1984	17.053	14.210	9.268	9.313	49.844
1985	18.347	15.250	9.481	9.247	52.325
1986	19.473	16.354	10.146	9.800	55.773
1987	20.604	17.483	11.028	10.538	59.653
1988	21.744	18.531	11.964	11.471	63.710
1989	23.845	20.039	12.780	11.880	68.544
1990	26.673	21.953	13.410	12.424	74.460
1991	29.017	23.454	14.482	12.913	79.866
Average Annual Growth (%)	**7%**	**7.9%**	**6%**	**5.4%**	

Source: KNR, Statistical Yearbook, 1986-1991.

[1] The total passenger excludes Seoul-Suwon portion of Kyongbu Line.

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Table 8: Total Passengers on Kyongbu Line by Section[1] (1984-1991)
(Million Passengers)

Year	Seweon-Cheonan	Cheonan-Daejon	Daejon-Dongdaegu	Dongdaegu-Busan	Total
1984	17.053	14.210	9.268	9.313	49.844
1985	18.347	15.250	9.481	9.247	52.325
1986	19.473	16.354	10.146	9.800	55.773
1987	20.604	17.483	11.028	10.538	59.653
1988	21.744	18.531	11.964	11.471	63.710
1989	23.845	20.039	12.780	11.880	68.544
1990	26.673	21.953	13.410	12.424	74.460
1991	29.017	23.454	14.482	12.913	79.866
Average Annual Growth (%)	7%	7.9%	6%	5.4%	

Source: KNR, Statistical Yearbook, 1986-1991.

[1] The total passenger excludes Seoul-Suwon portion of Kyongbu Line.

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Table 9: Kyongbu Line Passenger Traffic by Train Type[a] (1984-1991)
(Million Passengers)

Year	1st Class Saemaeul	2nd Class Mugunghwa	3rd Class Tongil	4th Class Ordinary & Others	Total
1984	1.683	10.388	25.760	19.214	57.040
1985	1.901	13.284	26.305	17.004	58.494
1986	2.441	17.455	25.690	14.695	60.481
1987	3.771	20.904	25.808	13.039	63.522
1988	4.888	23.929	26.118	11.883	66.818
1989	5.518	26.851	28.347	10.355	71.071
1990	6.296	31.007	31.321	8.700	76.824
1991	7.322	34.695	33.925	7.548	83.490
Average Annual Growth (%)	**24%**	**19%**	**4%**	**-13%**	

[a] Passengers included brom Seoul-Seowon.
Source: KNR, Statistical Yearbook, 1986-1991.

Table 10: Kyongbu Line Freight Traffic by Sections (1984-91)
(Million Tons)

Year	Total Tons				Total
	Seweon-Cheonan	Cheonan-Daejon	Daejon-Dongdaegu	Dongdaegu-Busan	
1984	4.004	4.443	3.570	2.961	14.9--
1985	4.017	4.429	3.253	2.959	14.6--
1986	3.718	4.221	3.516	2.958	14.40-
1987	3.765	4.215	3.630	3.217	14.82-
1988	3.883	4.408	3.447	3.160	14.858
1989	3.768	4.487	3.249	3.146	14.850
1990	4.183	4.838	3.843	3.501	16.365
1991	4.258	5.082	4.245	3.897	17.482
Average Annual Growth (%)	**1%**	**2%**	**3%**	**4%**	**3%**

Source: KNR, Statistical Yearbook of Railroad, 1991.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
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Table 10: Kyongbu Line Freight Traffic by Sections (1984-91)
(Million Tons)

Year	Total Tons				Total
	Seweon-Cheonan	Cheonan-Daejon	Daejon-Dongdaegu	Dongdaegu-Busan	
1984	4.004	4.443	3.570	2.961	14.9-
1985	4.017	4.429	3.253	2.959	14.6-
1986	3.718	4.221	3.516	2.958	14.40-
1987	3.765	4.215	3.630	3.217	14.82-
1988	3.883	4.408	3.447	3.160	14.898
1989	3.768	4.487	3.249	3.146	14.850
1990	4.183	4.838	3.843	3.501	16.365
1991	4.258	5.082	4.245	3.897	17.482
Average Annual Growth (%)	**1%**	**2%**	**3%**	**4%**	**3%**

Source: KNR, Statistical Yearbook of Railroad, 1991.

KOREA SEOUL-BUSAN CORRIDOR PROJECT
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Table 11: Comparison of SAR and Final Project Cost
(US$ million)

Component	Appraisal Estimate			Final Cost			Actual as % of Appraisal
	Local	Foreign	Total	Local	Foreign	Total	
Signalling Control Center Interlockings Automatic Block System Automatic Trans Stp. Level Crossings Hot Box Detectors Train Info System Miscellaneous	17.0	43.6	60.6	21.7	26.1	47.8	78.9%
Power Supply Substations Distribution Station Equipment Scade System	3.0	4.4	6.4	6.0	3.3	8.3	129.7%
Communications Carrier System Cable System Dispatchers Phone	8.9	9.5	18.4	3.2	3.2	6.4	34.8%
Equipment Rooms	4.4	---	4.4	6.5	0	6.5	147.7%
Supervision	3.8	---	3.8	n.a.	---	---	
Coaches	51.1	---	51.1	n.a.	---	---	
Materials, etc.	10.0	---	10.0	3.1	0.7	3.8	38.0%
Base Cost	**98.3**	**56.4**	**154.7**	**40.5**	**33.3**	**73.8**	**47.7%**
Physical Contingencies	4.9	0.6	5.5	---	---	---	
Price Contingencies	8.1	10.0	18.1	---	---	---	
Total Project Cost	**111.3**	**67.0**	**178.3**	**40.5**	**33.3**	**73.8**	**41.9%**

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Table 12: Procurement of Bank Financed Items
(As of December 31, 1991)

Allocation Amount (US$ Million)	Date	Number (IBRD/I-KOS-)	Contract Amount C.I.F. In Cont. Curr.	Contract Amount C.I.F. In US$ Equiv.	Contractor	Shipped Date Contracted First	Shipped Date Contracted Last	Shipped Date Actual First	Shipped Date Actual Last	Total US$ Equivalent	Actual as % of Contract Amount
I. Signalling Equipment and materials 33.6											
1) Computer, CTC Equipment (PI-1)	08/27/86	861535-F3	$2,511,344 W4,073,181,000	7,536,696	Gold Star Instrument Co.	09/29/86	03/31/88	12/05/86		6,999,116	93
	*12/31/88	884568-F3	$1,042,345 W1,775,642,926	3,571,496	Gold Star Industrial System Co., Ltd.	12/31/88	04/30/90	06/14/89		2,004,594	56
2) Communication (PI-2)	08/27/86	861536-F3	W1,172,457,600	1,290,997	Daewoo Telecom. Co.	09/29/86	09/15/87	10/31/86	11/14/87	1,290,997	100
	*02/22/89	890332-F3	W168,943,002	241,689	Daewoo Telecom. Co.	02/22/89	03/31/90	07/26/89	04/11/90	241,690	100
3) Interlockings Automatic Block (PII)	06/30/86	860877-F3	W4,694,408,952	5,592,188	Gold Star T.E. Co.	06/23/86	03/31/88	07/19/86	02/10/88	5,592,188	100
	*12/31/88	884568-f3	W2,157,945,941	3,170,352	Gold Star Industrial System Co., Ltd.	12/31/88	04/30/90	06/14/89	06/--/90	3,170,352	100
4) Cables (PIII)	06/03/89	860878-F3	W2,737,342,870	3,225,077	Kukje Wire Co.	06/23/86	12/30/87	---	---	3,225,077	100
	*06/08/89	890983-F3	W1,038,077,800	1,513,842	Shin Seong Ind'l Co.	06/21/89	08/31/89	07/26/89	08/22/90	1,513,842	100
	*10/31/90	903621-F3	W194,190,800	270,951	Shin Seong Ind'l Co.	11/19/90	03/06/91	12/28/90	01/11/91	270,951	100
	*10/31/90	903622-F3	W141,344,400	197,381	Gold Star Cable Co., Ltd.	11/19/90	12/30/90	12/28/90	12/28/90	197,381	100
	*10/31/90	903620-F3	W132,340,400	181,863	Daewon Cable Co.	11/19/90	03/06/91	03/07/91	03/07/91	181,863	100
5) Automatic Train Stop (PIV)	08/27/86	861537-F3	W2,289,646,663	2,818,211	Oriental Precision Co.	09/29/86	06/30/87	10/15/86	08/17/87	2,818,211	100
	*03/10/89	890406-F3	W493,812,670	741,643	Oriental Machinery Co.	03/10/89	04/30/90	05/18/89	04/28/90	741,643	100

* Contracts for the CTC Project for Dongdaegu - Pusan Section.

Allocation Amount (US$ Million)	Date	Number (IBRD/I-KOS-)	Contract Amount C.I.F.		Contractor	Shipped Date				Total US$ Equivalent	Actual as % of Contract Amount
						Contracted		Actual			
			In Cont. Curr.	In US$ Equiv.		First	Last	First	Last		
6) Miscellaneous (PV)	07/10/86	861107-861115-F3	W316,836,430	360,109	Konjin Machinery Co. and others	07/18/86	08/18/86	08/08/86	09/10/86	360,109	100
	07/21/86	861217-861218-F3	W39,000,000	44,609	Gold Star Telecom. and others	08/05/86	08/20/86	08/26/86	08/26/86	44,609	100
	07/31/86	861309-861310-F3	W186,188,000	214,225	Daekwang Kunep and others	08/12/86	11/10/86	09/17/86	11/20/86	214,225	100
	08/16/86	861423-861424-F3	W6,199,300	7,090	Shina Electric Co. and others	09/30/86	09/30/86	09/22/86	09/25/86	7,090	100
	08/30/86	861651-861424-F3	W95,691628	108,716	Shinseong Industrial Co. and others	09/09/86	11/30/86	09/13/86	03/06/87	108,716	100
	03/04/87	870968-870976-F3	W247,681,595	303,282	Dae Myong Electric Co.	05/18/87	06/30/87	07/04/87	11/04/87	303,282	100
	05/13/87	871021-F3	W35,200,000	37,829	Gold Star Industrial Co.	06/22/87	06/30/87	10/10/87	10/10/87	37,829	100
	05/14/87	871041-F3	W3,506,000	4,361	Dae Young Co.	05/27/87	06/30/87	07/10/87	07/10/87	4,361	100
	05/20/87	871088-871090-F3	W48,244,600	57,526	Hanyang	06/01/87	07/31/87	07/10/87	09/09/87	57,526	100
	05/30/87	871165-871168-F3	W220,395,000	270,786	Dongil	06/05/87	07/31/87	06/18/87	10/16/87	270,786	100
	06/04/87	871218-F3	W12,775,887	15,883	Hanil Cement	06/15/87	07/31/87	08/03/87	08/05/87	15,883	100
	06/27/87	871428-F3	W49,850,000	62,064	Yean Kyong Co.	07/09/87	08/31/87	09/05/87	09/05/87	62,064	100
	05/27/88	881224-F3	W237,200,000	331,655	Gold Star Ind. System, Co.	05/27/88	08/27/88	10/06/88	10/06/88	331,655	100
	07/04/88	881598-F3	W110,796,000	154,830	Kukje Electric Wire Co.	07/04/88	11/05/88	10/04/88	10/04/88	154,830	100

* Contracts for the CTC Project for Dongdaegu - Pusan Section.

Allocation Amount (US$ Million)	Date	Number (IBRD/I-KOS-)	Contract Amount C.I.F.		Contractor	Shipped Date				Total US$ equivalent	Actual as % of Contract Amount
			In Cont. Curr.	In US$ Equiv.		Contracted		Actual			
						First	Last	First	Last		
6) Miscellaneous, con't. (PV)	*03/28/89	890524-890530-F3	W277,077,664	411,594	Shin Seong Ind. Co. and others	03/30/89	05/20/89	05/25/89	07/03/89	411,594	100
	*05/19/89	890838-890839-F3	W254,832,000	376,763	Shin Seong Ind. Co. and others	06/01/89	07/31/89	06/23/89	11/01/89	376,763	100
	*09/30/91	911827-F3	$ 64,281	64,281	Hewlett - Packard Asia	10/15/91	12/31/91	10/28/91	11/02/91	64,281	100
II. Technical Assistance 0.4	---	---	---	60,000	---	---	---	---	---	34,200	57
III. Training 0.6				545,000				10/29/87		306,417	56
TOTAL 34.6				33,782,989**						31,414,270	93

* Contracts for the CTC Project for Dongdaegu - Pusan Section.

** Undisbursed amount of $1.7 million was cancelled on March 11, 1993.

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Table 13: Implementation Schedule

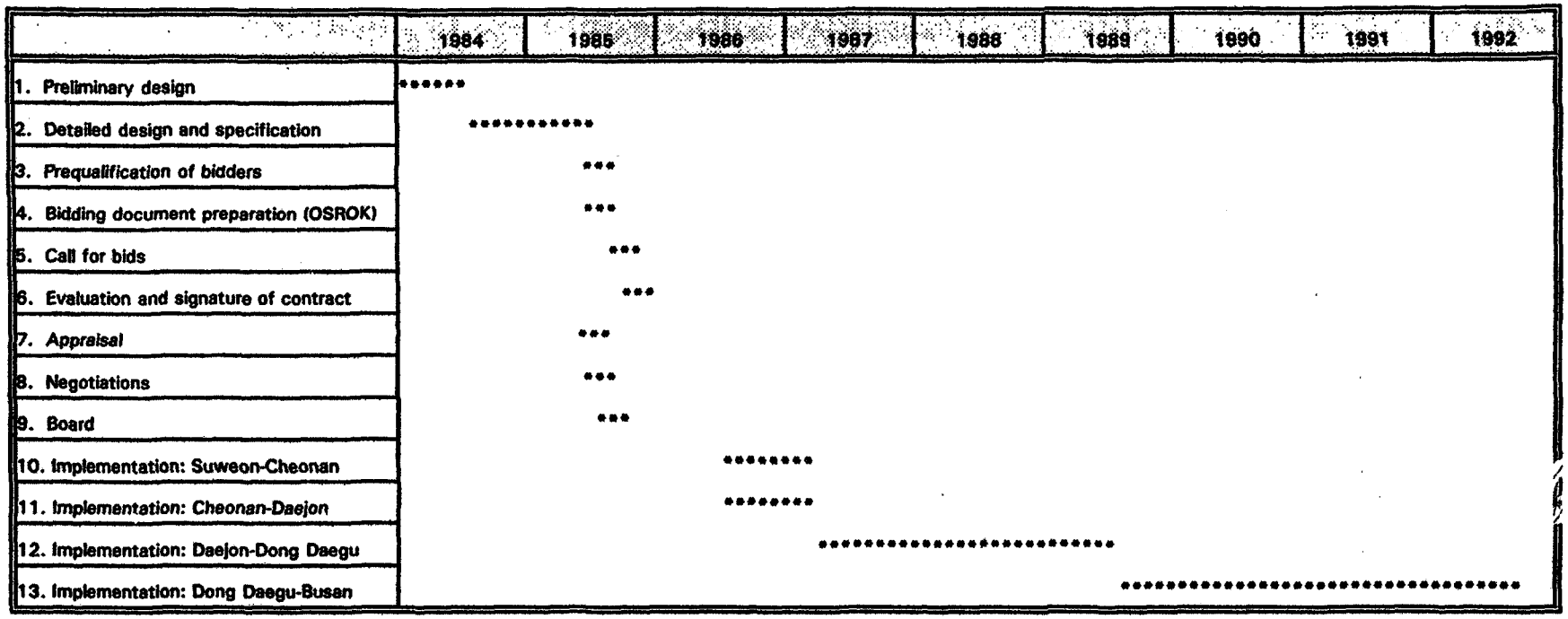

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Table 14: Overseas Training

Subject	No. of trainees	Duration (Man/Weeks)	Cost ($)
C T C	33	239	143,811
Highspeed Rail	33	81	140,629
Computer	5	10	21,977
Preparation for Restructuring of KNR	61	114	151,767
Computer operation	16	32	3,616
Rolling stock maintenance	8	16	43,200
Total	**156**	**492**	**545,000**

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Table 15: Progress of Management Improvement Plan

I. Reduction of Operating Frequency of Bidulgi Train								
Year	'85	'86	'87	'88	'89	'90	'91	'92
Daily Operating Frequency	476	471	463	435	385	365	274	274
Reduction	**14**	**5**	**8**	**28**	**50**	**20**	**91**	**0**

II. Number of Closed and Downgraded Stations								
Classification		Actual						
		'85	'86	'87	'88	'89	'90	'91
Closed	Station		1			6	3	
	Simple Station							
Downg...ded Station *		7	3	2	2	2	4	1
Total		**7**	**4**	**2**	**2**	**8**	**7**	**1**

* From Station to Simple Station

III. Abolishment of Unprofitable Line				
Classification	Section	Length (km)	No. of Station	Abolished Date
Ansong Line	Chonan-Ansong	28.4	6	January 1, 1989
Jinsam Line	Kaeyang-Samchonpo	29.1	3	January 20, 1990
Total		**57.5**	**9**	

IV. Conversion of KNR to Public Corporation	
December 30, 1989:	The Railway Corporation Law was enacted.
September 26, 1990:	The Corporation Establishment Affairs Bureau was opened.
August ,1992:	The government policy for implementing the conversion of KNR into a public corporation was reported to the President.

V. Construction of the Modern Station Building Under Joint Venture Project With Private Companies

Station	Construction Work		Scale
	Starting Date	Completion Date	
Seoul	July 31, 1987	March 11, 1989	Above ground : 3 stories Underground : 2 stories Area : 25,129m²
Tonginchon	June 16, 1987	April 10, 1989	Above ground : 5 stories Underground : 3 stories Area : 22,622m²
Youngdeungpo	September 1, 1987	May 4, 1991 (Open to passenger services only in July 21, 1990)	Above ground : 8 stories Underground : 5 stories Area : 94,338m²
Pupyong	July 22, 1992	1995	Above ground : 8 stories Underground : 3 stories Area : 46,900m²
Puchon	1992	1995	Above ground : 8 stories Underground : 2 stories Area : 61,170m²
Chongryangri	1993	1996	Above ground : 12 stories Underground : 3 stories Area : 128,760m²
Taegu	1993	1997	Above ground : 12 stories Underground : 5 stories Area : 126,000m²
Taejeon	1993	1997	Above ground : 9 stories Underground : 3 stories Area : 95,860m²
Wangsibri	1993	1996	Above ground : 6 stories Underground : 3 stories Area : 71,980m²

VI. Status of Increased Tariff Rate (Unit : %)

Date	Passenger				Freight	Remark (Average)
	Saemaul	Mugunghwa	Tongil	Bidulgi		
December 31, 1990	15	8	8	8	15	12.3
July 27, 1992	17.7	12	8	8	7	9.8

VII. Rental Car Service

April 10, 1986 : KNR began rental car services to passengers.
September 30, 1992 : Rental car service in place at 35 stations.

Rental cars are owned by private companies.

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Table 16: Income Statement
For the Twelve Months Ended December 31
(Won millions)

Account	1984	1985	1986	1987	1988	1989	1990	1991	1992
Operating Revenue									
Passenger	272,150	294,474	321,167	349,706	380,897	424,872	478,277	582,974	639,221
Baggage	13,206	13,154	13,656	13,973	15,270	17,356	19,480	23,613	41,723
Freight	217,810	230,813	244,892	249,713	262,445	256,769	257,755	310,923	310,844
Other	66,333	24,518	42,444	37,776	48,052	60,120	72,589	45,096	
Total Operating Revenue	**569,499**	**563,959**	**622,159**	**651,168**	**706,664**	**759,117**	**828,101**	**962,606**	**991,788**
Other Income	22,973	37,302	25,250	30,243	46,385	77,909	51,613	65,009	51,299
Total Revenue	**592,472**	**601,261**	**647,409**	**681,411**	**753,049**	**837,026**	**879,714**	**1,027,615**	**1,043,087**
Operating Expenses									
Labor	212,209	223,014	243,895	266,302	301,842	365,188	432,146	527,836	609,226
Administration	115,658	101,902	105,427	114,247	119,761	126,009	131,966	145,046	(424,697
Asset Related	258,378	268,920	280,629	284,099	297,327	288,847	294,658	326,616	(
Total Operating Expenses	**586,245**	**593,836**	**629,951**	**664,648**	**718,930**	**780,044**	**858,770**	**999,498**	**1,033,923**
Non-Operating Expenses	3 897	1,996	1,524	1,247	1,123	1,753	1,309	1,972	(89,707
Other Expenses	14,155	15,768	22,771	19,190	35,842	57,587	21,780	27,689	(
Total Other Expenses	**18,052**	**17,764**	**24,295**	**20,437**	**36,965**	**59,340**	**23,089**	**29,661**	**89,707**
Net Income (Loss)	**(11,825)**	**(10,339)**	**(6,837)**	**(3,674)**	**(2,846)**	**(2,358)**	**(2,145)**	**(1,544)**	**(80,543)**

Source: KNR (1993)

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Table 17: Balance Sheet
As of December 31
(Won millions)

Account	1984	1985	1986	1987	1988	1989	1990	1991	1992
Current Assets									
Cash	15,053	10,430	14,558	13,740	13,332	23,989	80,371	130,820	167,712
Accounts Receivable - net of allowance for doubtful accounts	22,268	22,729	26,638	27,534	31,050	34,007	36,700	38,278	34,735
Inventory/Materials	36,034	41,198	38,273	37,407	38,548	37,283	40,756	46,627	48,220
Other	8,819	18,233	9,004	15,853	12,369	13,149	30,867	73,562	92,810
Total Current Assets	**82,174**	**92,590**	**88,473**	**94,534**	**95,299**	**108,428**	**188,694**	**289,287**	**343,477**
Fixed Assets									
Land	676,493	857,070	890,147	921,301	949,273	932,475	1,331,896	1,394,900	1,394,900
Structures & Equipment	2,516,115	2,735,482	2,978,890	3,209,804	3,446,959	3,618,008	3,936,296	4,384,662	4,199,734
Less Accumulated Depreciation	(662,355)	(728,592)	(804,008)	(853,934)	(945,713)	(1,023,813)	(1,111,244)	(1,194,300)	(1,267,847)
Net Fixed Assets	**2,530,253**	**2,863,960**	**3,065,029**	**3,277,171**	**3,450,519**	**3,526,670**	**4,156,948**	**4,585,262**	**4,326,787**
Work in Process	0	1,212	8,328	18,046	21,750	25,558	29,062	34,472	970,890
Deferred Assets	13,831	94,067	136,085	181,604	128,647	66,536	84,122	80,897	63,614
Total Assets	**2,626,258**	**3,051,829**	**3,297,915**	**3,571,355**	**3,696,215**	**3,727,192**	**4,458,826**	**4,989,918**	**5,704,768**

Source: KNR (1993)

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 18: Liabilities and Equities
As of December 31
(Won millions)

Account	1984	1985	1986	1987	1988	1989	1990	1991	1992
Current Liabilities									
Accounts Payable	37,826	59,299	55,129	65,706	73,132	67,211	53,928	78,910	(435,395
Accrued Interest & Interest Payable	12,010	9,063	8,204	8,918	7,809	8,533	6,276	5,930	(
Current Portion of Long Term Debt	97,516	84,028	62,847	74,911	81,118	76,537	87,444	95,059	95,059
Deposits & Other	46,398	65,068	85,201	130,756	131,990	62,017	245,532	419,756	400,000
Total Current Liabilities	193,750	217,458	211,381	280,291	294,049	214,298	393,180	599,655	930,454
Long Term Debt	892,886	1,020,489	1,151,553	1,252,997	1,178,220	1,164,710	1,250,611	1,372,806	1,693,658
Provision for Pension Fund and Deferred Liabilities	18,178	20,381	19,841	20,147	90,101	57,018	47,751	38,774	30,388
Equity									64,990
Fixed Capital	64,990	64,990	64,990	64,990	64,990	64,990	64,990	64,990	
Capital Surplus									
Revaluation Surplus	1,448,011	1,646,685	1,734,746	1,797,468	1,852,617	1,852,617	2,311,867	2,311,867	(3,309,833
Donated, Other Surplus	186,248	269,970	310,385	346,124	433,374	613,883	632,896	845,838	(
Earned Surplus									
Beginning Balance	(165,980)	(177,805)	(188,144)	(186,988)	(214,290)	(237,966)	(240,324)	(242,468)	(244,021)
Net Income (Loss)	(11,825)	(10,339)	(6,837)	(3,674)	(2,846)	(2,358)	(2,145)	(1,544)	(80,534)
Ending Balance	(177,805)	(188,144)	(194,981)	(190,662)	(217,136)	(240,324)	(242,469)	(244,012)	(324,555)
Total Equity	1,521,444	1,793,501	1,915,140	2,017,920	2,133,845	2,291,166	2,767,284	2,978,683	3,050,268
Total Liabilities and Equity	2,626,258	3,051,829	3,297,915	3,571,355	3,696,215	3,727,192	4,458,826	4,989,918	5,704,768

Source: KNR (1993)

KOREA SEOUL-BUSAN CORRIDOR PROJECT
Loan 2600-KO

Table 19: Economic Evaluation
(Won billion)

A. Signalling Component

Year	COSTS			BENEFITS					NET BENEFITS
	Constr.	Maint.	Total	Seweon/ Cheonan	Cheonan/ Daejon	Daejon/ Dongdaeg	Dongdaeg/ Pusan	Total	
1986	10.00		10.00					0.00	-10.00
1987	15.00		15.00					0.00	-15.00
1988	15.00		15.00	5.01	4.27	2.76	2.64	14.68	-0.32
1989	10.00		10.00	6.32	5.31	3.39	3.15	18.16	8.16
1990		1.36	1.36	7.41	6.11	3.73	3.46	20.72	19.36
1991		1.36	1.36	8.71	7.04	4.34	3.87	23.96	22.60
1992		1.36	1.36	10.01	8.09	5.00	4.45	27.55	26.19
1993		1.36	1.36	11.51	9.31	5.75	5.12	31.69	30.33
1994		1.36	1.36	13.24	10.70	6.61	5.89	36.44	35.08
1995		1.36	1.36	21.33	17.24	7.60	6.78	52.94	51.58
1996		1.36	1.36	21.33	17.24	8.74	7.79	55.10	53.74
1997		1.36	1.36	21.33	17.24	10.05	8.96	57.58	56.22
1998		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
1999		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2000		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2001		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2002		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2003		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2004		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2005		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2006		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2007		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2008		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2009		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
2010		1.36	1.36	21.33	17.24	13.04	11.63	63.23	61.87
									48.56%

B. CTC Component

Year	COSTS			BENEFITS					NET BENEFITS
	Constr.	Maint.	Total	Seweon/ Cheonan	Cheonan/ Daejon	Daejon/ Dongdaeg	Dongdaeg/ Pusan	Total	
1986								0.00	-1.90
1987	1.90		1.90					0.00	-1.90
1988	1.90		1.90					0.00	-1.90
1989	1.90		1.90					5.18	3.28
1990	1.90		1.90	1.86	1.53	0.93	0.86	5.99	4.09
1991	1.90		1.90	2.18	1.76	1.09	0.97	6.89	6.55
1992		0.34	0.34	2.50	2.02	1.25	1.11	7.92	7.58
1993		0.34	0.34	2.88	2.33	1.44	1.28	9.11	8.77
1994		0.34	0.34	3.31	2.68	1.65	1.47	13.24	12.90
1995		0.34	0.34	5.33	4.31	1.90	1.69	13.77	13.43
1996		0.34	0.34	5.33	4.31	2.18	1.95	14.39	14.05
1997		0.34	0.34	5.33	4.31	2.51	2.24	15.81	15.47
1998		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
1999		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2001		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2002		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2003		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2004		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2005		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2006		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2007		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2008		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2009		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
2010		0.34	0.34	5.33	4.31	3.26	2.91	15.81	15.47
									58.81%

C. Composite

Year	COSTS			BENEFITS					NET BENEFITS
	Constr.	Maint.	Total	Seweon/ Cheonan	Cheonan/ Daejon	Daejon/ Dongdaeg	Dongdaeg/ Pusan	Total	
1986	10.00		10.00	0.00	0.00	0.00	0.00	0.00	-10.00
1987	16.90		16.90	0.00	0.00	0.00	0.00	0.00	-16.90
1988	16.90		16.90	5.01	4.27	2.76	2.64	14.68	-2.22
1989	11.90		11.90	6.32	5.31	3.39	3.15	18.16	6.26
1990	1.90	1.36	3.26	9.28	7.64	4.66	4.32	25.90	22.64
1991	1.90	1.36	3.26	10.88	8.80	5.43	4.84	29.95	26.69
1992		1.70	1.70	12.51	10.11	6.25	5.57	34.44	32.74
1993		1.70	1.70	14.39	11.63	7.18	6.40	39.61	37.91
1994		1.70	1.70	16.55	13.38	8.26	7.36	45.55	43.85
1995		1.70	1.70	26.66	21.55	9.50	8.47	66.18	64.48
1996		1.70	1.70	26.66	21.55	10.92	9.74	68.87	67.17
1997		1.70	1.70	26.66	21.55	12.56	11.20	71.97	70.27
1998		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
1999		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2000		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2001		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2002		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2003		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2004		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2005		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2006		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2007		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2008		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2009		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
2010		1.70	1.70	26.66	21.55	16.30	14.53	79.04	77.34
									49.81%

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